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(58) Field of search

UK CL (Edition K) H4K KYX, H4L LDSD LDSX

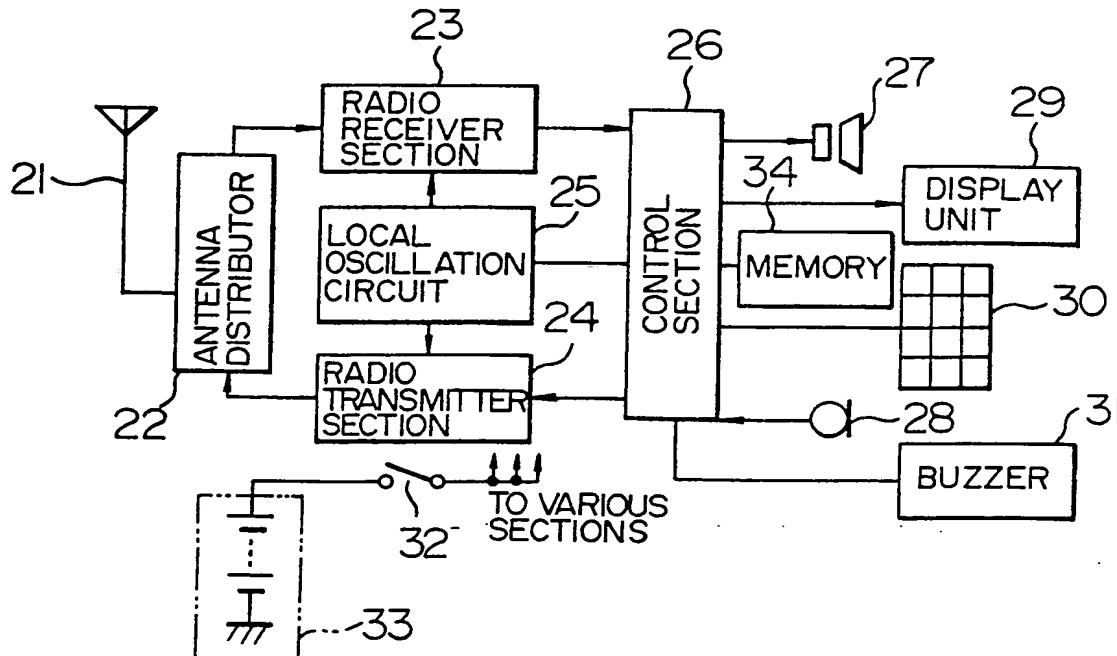
INT CL^s H04B 7/26, H04Q 7/04

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(54) Portable radio telephone

(57) This equipment monitors the control channel number of a cellular mobile telephone system, (CMTS), through a radio transmission section (24) and a control section (26) for common use to CMTS and a microcellular system, (MCS), and answers a call from a base station or performs transmission. On the other hand, this equipment selectively receives the control channel number of MCS and answers a call from a base station or performs transmission. Either one of these actions is automatically selected on the basis of the reception level and system ID of the control channel number. At this time, standby-state reception is performed on the judgement as to which one of CMTS and MCS is to be accessed, by automatically detecting the positional condition of the equipment in use. When the equipment is moved to a different area in CMTS or MCS, either one of CMTS and MCS is automatically accessed after position registration.

FIG. 2



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FIG. 1

(B)

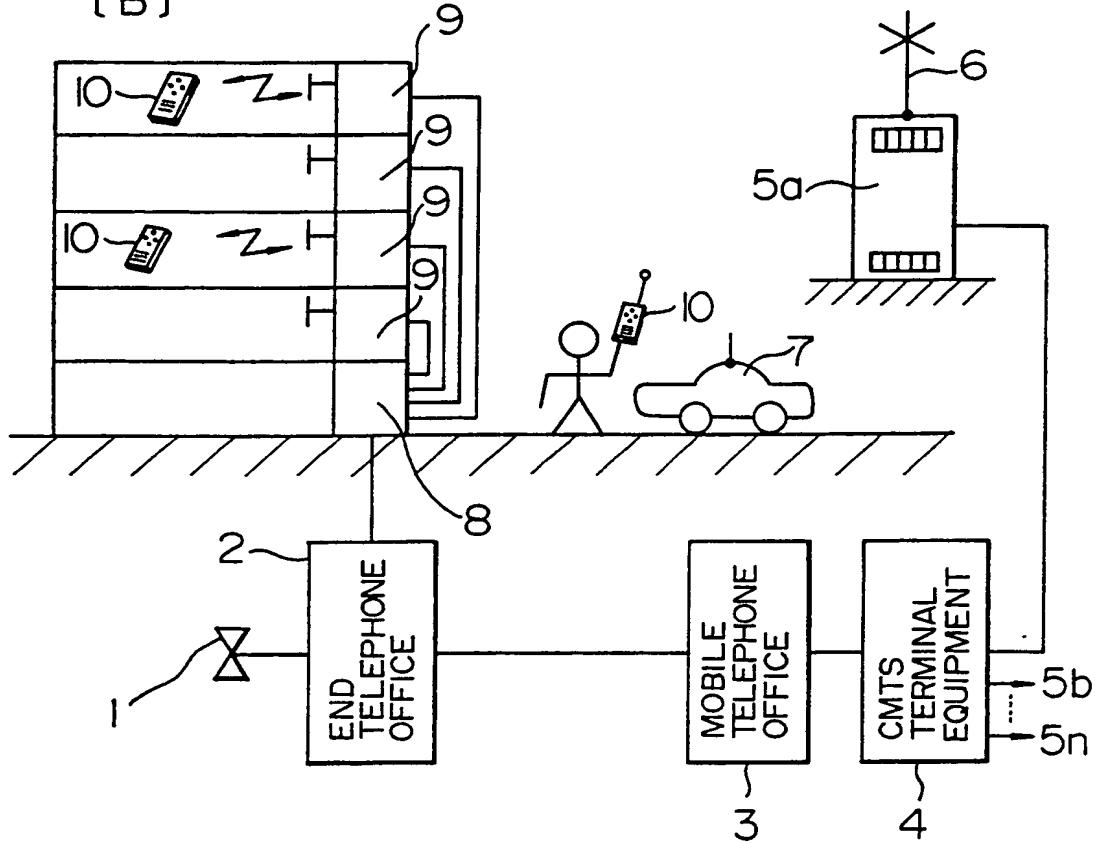


FIG. 2

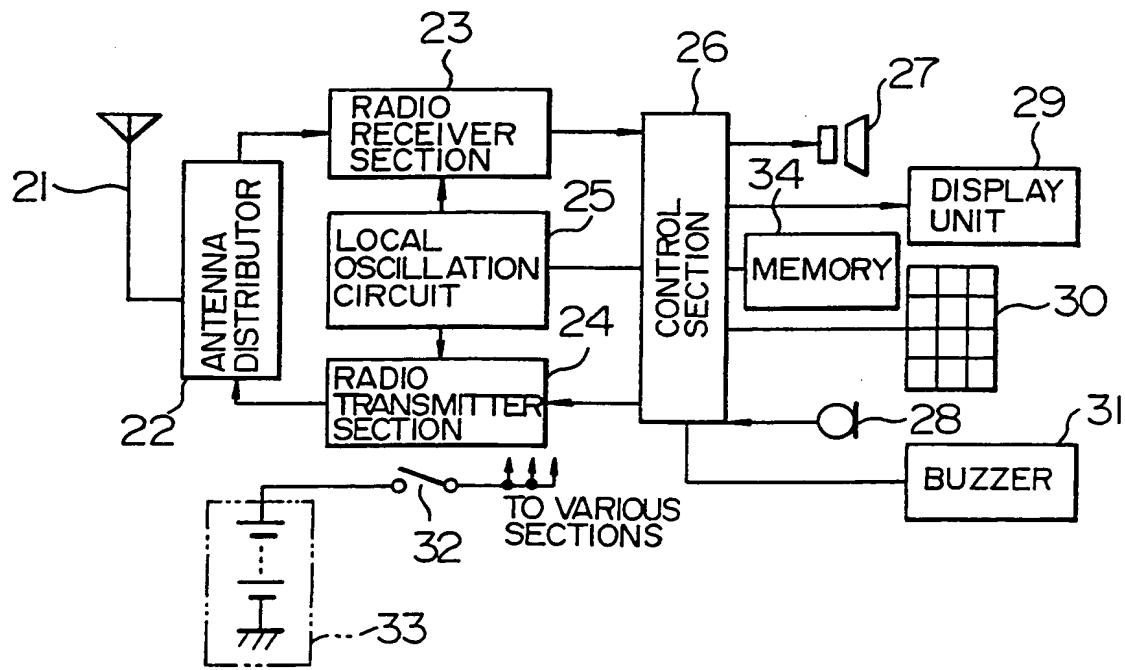
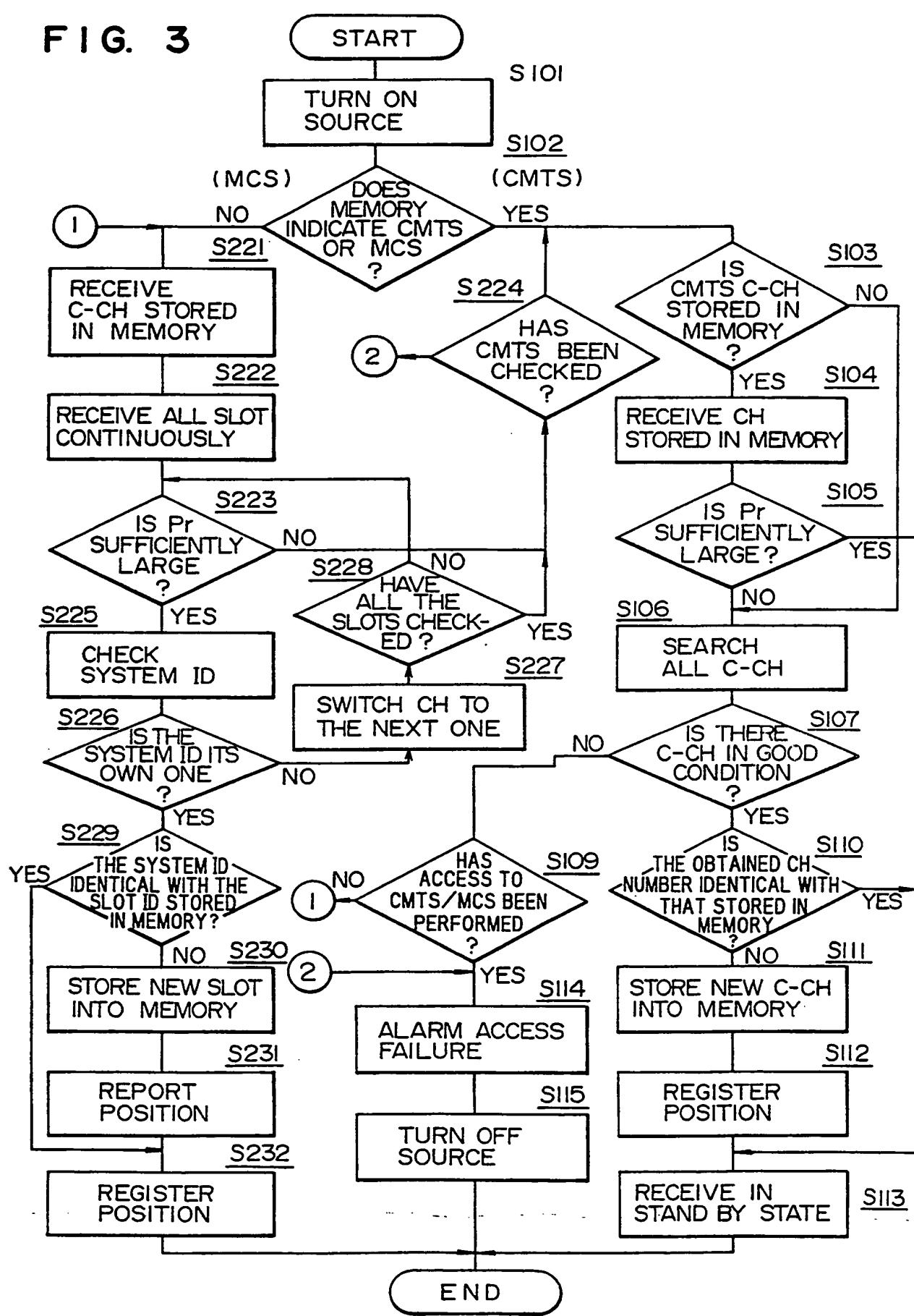


FIG. 3



1 BACKGROUND OF THE INVENTION

The present invention relates to a portable radio telephone equipment for common use for a cellular mobile telephone system (CMTS) and a micro cellular system (MCS), in which the frequency can be used in common so that either one of CMTS and MCS can be accessed automatically.

Heretofore, the cellular mobile telephone system (hereinafter also referred to as CMTS) has been used as a mobile communication system. On the other hand, the micro cellular system (hereinafter also referred to as MCS) has been used as a radio communication system using feeble radio wave in a limited range such as the inside of a building. The CMTS and the MCS respectively use frequency bands provided separately from each other.

SUMMARY OF THE INVENTION

In the CMTS, the service area is restricted by using a directional antenna. In this case, the frequency band used for the CMTS can be used for the MCS in a specific place such as the inside of a building located in an area of small electric field intensity outside the service area (beam area) restricted by the directional antenna. In the present state, however, the frequency

1 band used for the CMTS is not used for the MCS, that is,
effective use of frequency is not made. Furthermore,
there has been no precedent for use of frequency in
common to the CMTS and the MCS and for use of a portable
5 radio telephone equipment in common. Accordingly, there
arises a disadvantage in that efficiency both in use of
radio wave and in use of equipment is poor.

The present invention has as its object the provision of an excellent CMTS/MCS double-use portable
10 radio telephone equipment which can be used for CMTS and MCS in common in the double sense of frequency and equipment to improve efficiency both in use of frequency and in use of equipment to thereby eliminate the aforementioned disadvantage in the prior art.

15 In addressing the foregoing object, the CMTS/MCS double-use portable radio telephone equipment comprises: CMTS response transmission means for answering a call from a CMTS base station or for performing transmission through monitoring control channels of CMTS; MCS response transmission means for answering a call from an MCS base station or for performing transmission through selectively receiving control channels of MCS; and selection means for automatically selecting either one of the CMTS response transmission means and the MCS response
20 transmission means on the basis of the reception level and identification number of the control channels.

25 According to the CMTS/MCS double-use portable radio telephone equipment, the positional condition of

1 the equipment in use is automatically detected so that
standby-state reception is performed on the judgment as
to whether CMTS or MCS is to be accessed. Furthermore,
when the equipment is moved to a different area in CMTS
5 or MCS, either one of CMTS and MCS is automatically
accessed after position registration. As a result, both
the frequency and equipment can be used in common to CMTS
and MCS, so that the efficiency both in use of frequency
and in use of equipment can be improved.

10 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing the general config-
uration of the CMTS and MCS using a CMTS/MCS double-use
portable radio telephone equipment according to the
present invention;

15 Fig. 2 is a block diagram showing the configu-
ration of the CMTS/MCS double-use portable radio tele-
phone equipment as an embodiment of the present inven-
tion; and

Fig. 3 is a flow chart showing a series of
20 procedure for the operation of the equipment in the
embodiment depicted in Fig. 2.

DESCRIPTION OF PREFERRED EMBODIMENT

An embodiment of the present invention as to
the CMTS/MCS double-use portable radio telephone equip-
25 ment will be described below with reference to the draw-
ings.

1 Fig. 1 shows the configuration of the CMTS and
MCS. In Fig. 1, the reference numeral 1 designates a
wire telephone equipment, 2 an end telephone office
(E.O), 3 a mobile telephone office, 4 a CMTS terminal
5 equipment, 5 (5a, 5b to 5n) radio base stations, 6 a base
station antenna, 7 a mobile telephone equipment, 8 an MCS
terminal equipment in a building or the like, 9 an MCS
base station, and 10 a CMTS/MCS double-use portable radio
telephone equipment.

10 Fig. 2 shows the configuration of the CMTS/MCS
double-use portable telephone equipment 10. In Fig. 2,
the reference numeral 21 designates an antenna, 22 an
antenna distributor for transmission and reception, 23 a
radio receiver section used in common to the CMTS and
15 MCS, 24 a radio transmitter section used in common to the
CMTS and MCS, and 25 a local oscillation circuit con-
stituted by a frequency synthesizer for outputting an
oscillation signal for frequency conversion in the radio
receiver section 23 and the radio transmitter section 24.
20 The reference numeral 26 designates a control section for
performing control for communication connection to the
CMTS or MCS and so on, the control section 26 being
provided with a memory 34 in the inside or outside there-
of. The reference numeral 27 designates a telephone
25 receiver, 28 a telephone transmitter, 29 a display unit
for displaying a dial number and so on, 30 a keyboard
section for entry of a telephone number and so on, 31 a
buzzer for producing a sound as a call signal, 32 an

1 electric source switch, and 33 a battery pack. The
memory 34 is constituted by an ROM (PROM) and an RAM.

In the following, the operation of the CMTS and
MCS will be described. The radio base stations 5a, 5b to
5 5n for the CMTS cover a service area within a radius of 3
km. The service area is divided into 120!k sector zones
by directional antennas thereof. Because the MCS is
adapted for radio communication between floors in the
inside of a building [B], a channel (CH) allowed to be
10 used for the MCS is selected from a CMTS frequency band.

The CMTS/MCS double-use portable radio tele-
phone equipment 10 serves as a mobile telephone equipment
7 in Fig. 1 in the case of use of the CMTS and also as an
MCS telephone equipment. The transmission electric power
15 of the CMTS/MCS double-use portable radio telephone
equipment 10 is set to be not larger than about 100 mW.
That is, in the case where the CMTS/MCS double-use
portable radio telephone equipment 10 is used in the
inside of the building [B], not only consideration of
20 avoiding interference with the CMTS is provided by the
setting of the transmission electric power but considera-
tion of avoiding influence of the CMTS is provided by
setting the 120!k sector zone of the directional antenna
out of the service area in the site of the CMTS.

25 In the following, the operation of the CMTS/MCS
double-use portable radio telephone equipment 10 shown in
Fig. 2 will be described below.

Fig. 3 shows a flow of the operation. In a

1 step 101, the electric source switch 32 is turned on. When, for example, the radio receiver section 23 of the CMTS/MCS double-use portable radio telephone equipment 10 is started, the fact that which one of the CMTS and MCS
5 had been operating just before the last turning-off of the electric source switch 32 has been stored in the memory 34 in the control section 26. In a step 102, access to the storage in the memory 34 is made under the control of the control section 26 so as to judge whether
10 the storage in the memory 34 indicates the CMTS or not, and if the result of the judgement in the step 102 is "Yes", a judgment is made in a step 103 as to whether a C-channel for the CMTS is stored in the memory 34 or not. When the result of judgment in the step 103 is "Yes", the
15 channel stored in the memory 34 is received in a step 104. In a step 105, a judgment is made as to whether reception electric power (reception electric field intensity) P_r from the radio receiver section 23 is sufficiently large or not. When the reception electric power
20 P_r is sufficiently large, the situation of the routine goes to a step 113 in which the radio receiver section 23 is operated to be in a standby reception state under the control of the control section 26, and the series of procedure to this point is terminated.

25 In the case where the judgment in the step 103 proves that there is no C-channel stored in the memory 34 or in the case where the result of the judgment in the step 103 is "Yes" but the reception electric power P_r of

1 the channel stored in the memory 34 is not sufficiently
large, all the C-channels in each zone for the CMTS are
searched under the control of the control section 26 in a
step 106 so that the reception electric power Pr of each
5 C-channel is stored together with the channel number
thereof. In a step 107, a judgment is made as to whether
there is any C-channel being in good condition or not.
When the result of the judgment in the step 107 is "Yes",
a judgment is made in a step 110 as to whether the chan-
10 nel number of the thus obtained channel is identical to
the channel number stored in the memory. When the result
of the judgment is "Yes", the situation of the routine
goes to the step 113 even though the reception electric
power Pr is insufficient. In the step 113, the radio
15 receiver section 23 is operated to be in a standby recep-
tion state, and the series of procedure to this point is
terminated.

When the result of the judgment in the step 107
proves that there is no channel in good condition, a
20 judgment is made in a step 109 as to whether access to
MCS has been performed or not. When the result of the
judgment in the step 109 is "No", the situation of the
routine goes to access to the MCS. When the result of
the judgment in the step 109 is "Yes", on the contrary,
25 an alarm for access failure is generated from the buzzer
31 under the control of the control section 26 in a step
114. Here, the user switches turn off the electric
source, so that the series of procedure to this point is

1 terminated.

Circuit connection may be cut off automatically so that a retrial can be made in predetermined timing. When the result of the judgment in the step 107 is "Yes", 5 a judgment is made in a step 110 again as to whether the channel number of the obtained channel is identical with the channel number stored in the memory 34. When the result of the judgment in the step 110 is "No", that is, when the channel number is not identical with the channel number stored in the memory 34, a new C-channel number is stored in the memory under the control of the control section 26 in a step 111. Then, in a step 112, position registration to report the position of the equipment by signal transmission is performed. Then, in 10 a step 113, the radio receiver section 23 is operated to be in a standby reception state and the series of procedure to this point is terminated. When the result of the judgment in the step 107 is "No", that is, when there is no channel in good condition, the C-channel allocated to 15 the MCS is received in a step 221. In a step 222, all slots are continuously received. In a step 223, a judgment is made as to whether there is any slot having sufficiently large reception electric power Pr. When the judgment proves that there is no slot having sufficiently 20 large reception power Pr, the situation of the routine goes to a step 224 in which a judgment is made as to whether the CMTS has been checked or not. When the 25 result of the judgment is "Yes", that is, when the CMTS

1 has been checked n times, an alarm for access failure is
generated from the buzzer 31 under the control of the
control unit 26 in a step 114. When the result of the
judgment in the step 223 is "Yes", the system ID (identi-
5 fication number) of the CMTS or MCS is checked in a step
225 and then a judgment is made in a step 226 as to
whether the checked system ID is the ID of its own system
or not. When the result of the judgment is "No", the
channel number is changed to the next one in a step 227
10 to detect the system ID of a slot having next-ranking
reception electric power Pr. In a step 228, a judgment
is made as to whether all the slots have been already
monitored or not. When the result of the judgment in the
step 228 is "Yes", the situation of the routine goes to a
15 step 224 in which access to the CMTS is performed. When
the result of the judgment in the step 226 is "Yes", the
situation of the routine goes to a step 229 in which a
judgment is made as to whether the system ID is identical
with the slot ID stored in the memory 34. When the
20 result of the judgment is "No", a new slot is stored in
the memory 34 in a step 230 and then the position of the
equipment is reported in a step 231. After position
registration, in a step 232, the radio receiver section
is operated to be in a standby reception state for the
25 MCS. Thus, the series of procedure to this point is
terminated.

As described above, which one of the CMTS and
MCS is to be accessed is judged on the basis of the

1 reception level and the system ID of the control channel
number. When the result of the judgment is not identical
with the storage in the memory, the storage in the memory
is rewritten so that changeover between the CMTS and MCS
5 is performed automatically. This changeover is reported
to the user.

As is obvious from above description, in the
CMTS/MCS double-use portable radio telephone equipment
according to the invention, standby-state reception is
10 performed on the judgment as to which one of the CMTS and
MCS is to be accessed, by automatically detecting the
positional condition of the equipment in use. When the
equipment is moved to a different area in the CMTS or
MCS, either one of the CMTS and MCS is automatically
15 accessed after position registration. Accordingly, there
arises an effect in that both the frequency and equipment
can be used in common to the CMTS and MCS to improve the
efficiency in use both for the frequency and for the
equipment.

WHAT IS CLAIMED IS:

1. A CMTS/MCS double-use portable radio telephone equipment provided with a common antenna, transmission and reception means, a power supply section and a control section, comprising:

CMTS response transmission means for answering a call from a CMTS base station through monitoring control channels of CMTS; MCS response transmission means for answering a call from an MCS base station through monitoring control channels of MCS; and

selection means for automatically selecting either one of the CMTS response transmission means and the MCS response transmission means on the basis of information concerning the receiver signal strength and identification number of the control channels.

2. A CMTS/MCS double-use portable radio telephone equipment according to claim 1, wherein said control section includes a memory for storing channel information and identification number information.

3. A CMTS/MCS double-use portable radio telephone equipment according to claim 2, wherein said memory is arranged so that when the channel information is updated, not only the updated channel information is stored therein but position registration is updated.

4. A CMTS/MCS double-use portable radio telephone equipment according to claim 2, wherein a result of said selection just before turning-off the power supply section is stored as said channel information.

5. A CMTS/MCS double-use portable radio telephone equipment substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

Relevant Technical fields

(i) UK CI (Edition K) H4L (LDSD LDSX)
H4K (KYX)(ii) Int CI (Edition 5) H04B 7/26
H04Q 7/04

Search Examiner

K WILLIAMS

Databases (see over)

(i) UK Patent Office

(iii) ONLINE DATABASE: WPI

Date of Search

24 DECEMBER 1992

Documents considered relevant following a search in respect of claims 1-4

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X E	GB 2255474 A	(VODAFONE) see Figure 3 and pages 13-16	1
X P	GB 2253968 A	(VODAFONE) see page 10, line 19 to page 11 line 10	1
X P	GB 2252699 A	(MATSUSHITA) see whole specification	1
X	GB 2242806 A	(STC) see whole specification	1
X	GB 2234649 A	(STC) see page 16, lines 10-30	1
X	EP 0418096 A2	(PCN ONE) see Claim 1	1



Category	Identity of document and relevant passages	Relevant to claim(s).

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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